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 THES=ASSIGNEE; PLUR=YES; OP=OR

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| <u>L12</u> | L11 not l10 | 11 | <u>L12</u> |
| <u>L11</u> | l9 and telemetr\$ | 16 | <u>L11</u> |
| <u>L10</u> | L9 and socket\$ | 5 | <u>L10</u> |
| <u>L9</u> | L6 and (navigat\$ with UAV\$) and remot\$ | 34 | <u>L9</u> |

| | | | |
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| <u>L4</u> | L3 and control\$ and navigat\$ | 1586 | <u>L4</u> |
| <u>L3</u> | UAV\$ or unmanned\$ | 18475 | <u>L3</u> |
| <i>DB=PGPB; THES=ASSIGNEE; PLUR=YES; OP=OR</i> | | | |
| <u>L2</u> | L1 and (ident\$ with instruct\$) | 1 | <u>L2</u> |
| <u>L1</u> | 20050094851 | 1 | <u>L1</u> |

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☐ **1. Document ID: US 20060167622 A1**

L10: Entry 1 of 5

File: PGPB

Jul 27, 2006

PGPUB-DOCUMENT-NUMBER: 20060167622

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060167622 A1

TITLE: Navigating UAVs in formations

PUBLICATION-DATE: July 27, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|-------------------------|------------|-------|---------|
| Bodin; William Kress | Austin | TX | US |
| Redman; Jesse | Cedar Park | TX | US |
| Thorson; Derral Charles | Austin | TX | US |

US-CL-CURRENT: 701/206; 701/3

| | | | | | | | | | | | | |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|-----|--------|
| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|-----|--------|

☐ **2. Document ID: US 20060167599 A1**

L10: Entry 2 of 5

File: PGPB

Jul 27, 2006

PGPUB-DOCUMENT-NUMBER: 20060167599

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060167599 A1

TITLE: Identifying a UAV landing location

PUBLICATION-DATE: July 27, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|-------------------------|------------|-------|---------|
| Bodin; William Kress | Austin | TX | US |
| Redman; Jesse | Cedar Park | TX | US |
| Thorson; Derral Charles | Austin | TX | US |

US-CL-CURRENT: 701/16; 340/947

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|-----|--------|
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|-----|--------|

☐ 3. Document ID: US 20060167597 A1

L10: Entry 3 of 5

File: PGPB

Jul 27, 2006

PGPUB-DOCUMENT-NUMBER: 20060167597

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060167597 A1

TITLE: Enabling services on a UAV

PUBLICATION-DATE: July 27, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|-------------------------|------------|-------|---------|
| Bodin; William Kress | Austin | TX | US |
| Redman; Jesse | Cedar Park | TX | US |
| Thorson; Derral Charles | Austin | TX | US |

US-CL-CURRENT: 701/3; 701/206

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|-----|--------|
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|-----|--------|

☐ 4. Document ID: US 20050094851 A1

L10: Entry 4 of 5

File: PGPB

May 5, 2005

PGPUB-DOCUMENT-NUMBER: 20050094851

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20050094851 A1

TITLE: Navigating a UAV with telemetry through a socket

PUBLICATION-DATE: May 5, 2005

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|----------------------|------------|-------|---------|
| Bodin, William Kress | Austin | TX | US |
| Redman, Jesse J.W. | Cedar Park | TX | US |
| Thorson, Derral C. | Austin | TX | US |

US-CL-CURRENT: 382/106; 343/705, 382/107, 382/108, 382/154, 398/121, 701/2, 701/3, 701/36

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|-----|--------|
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☐ 5. Document ID: US 6056237 A

L10: Entry 5 of 5

File: USPT

May 2, 2000

US-PAT-NO: 6056237

DOCUMENT-IDENTIFIER: US 6056237 A

TITLE: Sonotube compatible unmanned aerial vehicle and system

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Searches | Attachments | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|----------|-------------|--------|------|--------|
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☐ 1. Document ID: US 20060217877 A1

L12: Entry 1 of 11

File: PGPB

Sep 28, 2006

PGPUB-DOCUMENT-NUMBER: 20060217877

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060217877 A1

TITLE: NAVIGATING A UAV WITH ON-BOARD NAVIGATION ALGORITHMS WITH FLIGHT DEPICTION

PUBLICATION-DATE: September 28, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|----------------------|------------|-------|---------|
| Bodin; William Kress | Austin | TX | US |
| Redman; Jesse J.W. | Cedar Park | TX | US |
| Thorson; Derral C. | Austin | TX | US |

US-CL-CURRENT: 701/206; 701/23

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|-----|--------|
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☐ 2. Document ID: US 20060167596 A1

L12: Entry 2 of 11

File: PGPB

Jul 27, 2006

PGPUB-DOCUMENT-NUMBER: 20060167596

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060167596 A1

TITLE: Depicting the flight of a formation of UAVs

PUBLICATION-DATE: July 27, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|-------------------------|------------|-------|---------|
| Bodin; William Kress | Austin | TX | US |
| Redman; Jesse | Cedar Park | TX | US |
| Thorson; Derral Charles | Austin | TX | US |

US-CL-CURRENT: 701/3; 701/301

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|
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☐ 3. Document ID: US 20060102798 A1

L12: Entry 3 of 11

File: PGPB

May 18, 2006

PGPUB-DOCUMENT-NUMBER: 20060102798

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060102798 A1

TITLE: Unmanned biplane for airborne reconnaissance and surveillance having staggered and gapped wings

PUBLICATION-DATE: May 18, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|------------------|-------------|-------|---------|
| Cox; Beverly | San Antonio | TX | US |
| Dews; Hampton | Medina | TX | US |
| Nyroth; Nicholas | San Antonio | TX | US |

US-CL-CURRENT: 244/190; 244/45R

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|

☐ 4. Document ID: US 20060058928 A1

L12: Entry 4 of 11

File: PGPB

Mar 16, 2006

PGPUB-DOCUMENT-NUMBER: 20060058928

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060058928 A1

TITLE: Programmable autopilot system for autonomous flight of unmanned aerial vehicles

PUBLICATION-DATE: March 16, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|--------------------|-------------|-------|---------|
| Beard; Randal W. | Orem | UT | US |
| Johnson; Walter H. | Provo | UT | US |
| Christiansen; Reed | Simi Valley | CA | US |
| Hintze; Joshua M. | Provo | UT | US |
| McLain; Timothy W. | Provo | UT | US |

US-CL-CURRENT: 701/11; 244/175

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|
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☐ 5. Document ID: US 20050090972 A1

L12: Entry 5 of 11

File: PGPB

Apr 28, 2005

PGPUB-DOCUMENT-NUMBER: 20050090972
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050090972 A1

TITLE: Navigating a UAV

PUBLICATION-DATE: April 28, 2005

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|----------------------|------------|-------|---------|
| Bodin, William Kress | Austin | TX | US |
| Redman, Jesse J.W. | Cedar Park | TX | US |
| Thorson, Derral C. | Austin | TX | US |

US-CL-CURRENT: 701/206; 701/200, 701/213

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|
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☐ 6. Document ID: US 20050090945 A1

L12: Entry 6 of 11

File: PGPB

Apr 28, 2005

PGPUB-DOCUMENT-NUMBER: 20050090945
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050090945 A1

TITLE: Navigating a UAV with a remote control device

PUBLICATION-DATE: April 28, 2005

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|----------------------|------------|-------|---------|
| Bodin, William Kress | Austin | TX | US |
| Redman, Jesse J.W. | Cedar Park | TX | US |
| Thorson, Derral C. | Austin | TX | US |

US-CL-CURRENT: 701/2; 701/213, 701/3

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|
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☐ 7. Document ID: US 7130741 B2

L12: Entry 7 of 11

File: USPT

Oct 31, 2006

US-PAT-NO: 7130741

DOCUMENT-IDENTIFIER: US 7130741 B2

TITLE: Navigating a UAV with a remote control device

PRIOR-PUBLICATION:

DOC-ID

DATE

US 20050090945 A1

April 28, 2005

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequence | Attachment | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|----------|------------|--------|-----|--------|
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☐ 8. Document ID: US 7107148 B1

L12: Entry 8 of 11

File: USPT

Sep 12, 2006

US-PAT-NO: 7107148

DOCUMENT-IDENTIFIER: US 7107148 B1

TITLE: Navigating a UAV with on-board navigation algorithms with flight depiction

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequence | Attachment | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|----------|------------|--------|-----|--------|
|------|-------|----------|-------|--------|----------------|------|-----------|----------|------------|--------|-----|--------|

☐ 9. Document ID: US 6856894 B1

L12: Entry 9 of 11

File: USPT

Feb 15, 2005

US-PAT-NO: 6856894

DOCUMENT-IDENTIFIER: US 6856894 B1

TITLE: Navigating a UAV under remote control and manual control with three dimensional flight depiction

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequence | Attachment | Claims | KMC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|----------|------------|--------|-----|--------|
|------|-------|----------|-------|--------|----------------|------|-----------|----------|------------|--------|-----|--------|

☐ 10. Document ID: US 6813559 B1

L12: Entry 10 of 11

File: USPT

Nov 2, 2004

US-PAT-NO: 6813559

DOCUMENT-IDENTIFIER: US 6813559 B1

TITLE: Orbiting a waypoint

| | | | | | | | | | | | | |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|---------|
| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KVMC | Draw. D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|---------|

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☐ 11. Document ID: US 6626398 B1

L12: Entry 11 of 11

File: USPT

Sep 30, 2003

US-PAT-NO: 6626398

DOCUMENT-IDENTIFIER: US 6626398 B1

TITLE: Unmanned biplane for airborne reconnaissance and surveillance having staggered and gapped wings

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Generate OACS | Abstracts | Claims | KWC | Draw. D |
|------|-------|----------|-------|--------|----------------|------|-----------|---------------|-----------|--------|-----|---------|
|------|-------|----------|-------|--------|----------------|------|-----------|---------------|-----------|--------|-----|---------|

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File: PGPB

May 5, 2005

PGPUB-DOCUMENT-NUMBER: 20050094851
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050094851 A1

TITLE: Navigating a UAV with telemetry through a socket

PUBLICATION-DATE: May 5, 2005

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|----------------------|------------|-------|---------|
| Bodin, William Kress | Austin | TX | US |
| Redman, Jesse J.W. | Cedar Park | TX | US |
| Thorson, Derral C. | Austin | TX | US |

ASSIGNEE-INFORMATION:

| NAME | CITY | STATE | COUNTRY | TYPE | CODE |
|---|--------|-------|---------|------|------|
| INTERNATIONAL BUSINESS MACHINES CORPORATION | ARMONK | NY | | | 02 |

APPL-NO: 10/692129 [PALM]
DATE FILED: October 23, 2003

INT-CL-PUBLISHED: [07] G06K 9/00, H04B 10/00, G06F 7/00, G05D 1/00, H01Q 1/28, H04N 9/47

INT-CL-CURRENT:

| TYPE | IPC | DATE |
|------|-------------------|----------|
| CIPP | <u>G05 D 1/02</u> | 20060101 |

US-CL-PUBLISHED: 382/106; 382/107, 382/108, 382/154, 398/121, 701/002, 701/003, 701/036, 343/705

US-CL-CURRENT: 382/106; 343/705, 382/107, 382/108, 382/154, 398/121, 701/2, 701/3, 701/36

REPRESENTATIVE-FIGURES: 5

ABSTRACT:

Navigating a UAV, including receiving in a remote control device a user's selection of a GUI map pixel that represents a waypoint for UAV navigation, the pixel having a location on the GUI; mapping the pixel's location on the GUI to Earth coordinates of the waypoint; receiving downlink telemetry, including a starting position from a GPS receiver on the UAV, from the UAV through a socket on the remote control

device; calculating a heading in dependence upon the starting position, the coordinates of the waypoint, and a navigation algorithm; identifying flight control instructions for flying the UAV on the heading; and transmitting uplink telemetry, including the flight control instructions, through the socket to the UAV. In some embodiments the UAV is piloted, under control of a navigation computer on the UAV, from the starting position to the waypoint in accordance with a navigation algorithm.

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L2: Entry 1 of 1

File: PGPB

May 5, 2005

DOCUMENT-IDENTIFIER: US 20050094851 A1

TITLE: Navigating a UAV with telemetry through a socket

Abstract Paragraph:

Navigating a UAV, including receiving in a remote control device a user's selection of a GUI map pixel that represents a waypoint for UAV navigation, the pixel having a location on the GUI; mapping the pixel's location on the GUI to Earth coordinates of the waypoint; receiving downlink telemetry, including a starting position from a GPS receiver on the UAV, from the UAV through a socket on the remote control device; calculating a heading in dependence upon the starting position, the coordinates of the waypoint, and a navigation algorithm; identifying flight control instructions for flying the UAV on the heading; and transmitting uplink telemetry, including the flight control instructions, through the socket to the UAV. In some embodiments the UAV is piloted, under control of a navigation computer on the UAV, from the starting position to the waypoint in accordance with a navigation algorithm.

Pre-Grant Publication (PGPub) Document Number:
20050094851

Summary of Invention Paragraph:

[0009] More particularly, methods, systems, and products are disclosed in this specification for navigating a UAV. Typical embodiments include receiving in a remote control device a user's selection of a GUI map pixel that represents a waypoint for UAV navigation, the pixel having a location on the GUI; mapping the pixel's location on the GUI to Earth coordinates of the waypoint; receiving downlink telemetry, including a starting position from a GPS receiver on the UAV, from the UAV through a socket on the remote control device; calculating a heading in dependence upon the starting position, the coordinates of the waypoint, and a navigation algorithm; identifying flight control instructions for flying the UAV on the heading; and transmitting uplink telemetry, including the flight control instructions, through the socket to the UAV.

Summary of Invention Paragraph:

[0011] Many embodiments also include receiving user selections of a multiplicity of GUI map pixels representing waypoints, each pixel having a location on the GUI; mapping each pixel location to Earth coordinates of a waypoint; assigning one or more UAV instructions to each waypoint; storing the coordinates of the waypoints and UAV instructions in computer memory on the remote control device; flying the UAV to each waypoint in accordance with one or more navigation algorithms; and operating the UAV at each waypoint in accordance with the UAV instructions for each waypoint. In such embodiments, operating the UAV at each waypoint in accordance with the UAV instructions also includes identifying flight control instructions in dependence upon the UAV instructions for each waypoint and transmitting the flight control instructions in the uplink telemetry through the socket from the remote control device to the UAV.

Detail Description Paragraph:

[0056] The system of FIG. 1 typically is capable of calculating a heading in dependence upon the starting position, the coordinates of the waypoint, and a navigation algorithm, identifying flight control instructions for flying the UAV on the heading, and transmitting (420) the flight control instructions from the remote control device to the UAV.

Detail Description Paragraph:

[0069] Remote control devices according to embodiments of the present invention typically include automated computing machinery capable of receiving user selections of pixel on GUI maps, mapping the pixel to a waypoint location, receiving downlink telemetry including for example a starting position from a GPS receiver on the UAV, calculating a heading in dependence upon the starting position, the coordinates of the waypoint, and a navigation algorithm, identifying flight control instructions for flying the UAV on the heading, and transmitting the flight control instructions as uplink telemetry from the remote control device to the UAV. FIG. 3 is a block diagram of an exemplary remote control device showing relations among components of included automated computing machinery. In FIG. 3, remote control device (161) includes a processor (164), also typically referred to as a central processing unit or 'CPU.' The processor may be a microprocessor, a programmable control unit, or any other form of processor useful according to the form factor of a particular remote control device as will occur to those of skill in the art. Other components of remote control device (161) are coupled for data transfer to processor (164) through system bus (160).

Detail Description Paragraph:

[0084] The method of FIG. 4 includes identifying (418) flight control instructions for flying the UAV on the heading. Flight control instructions are specific commands that affect the flight control surfaces of the UAV. That is, instructions to move the flight control surfaces to affect the UAV's flight causing the UAV to turn, climb, descend, and so on. As an aid to further explanation, an exemplary method of identifying flight control instructions for flying on a calculated heading is provided:

Detail Description Paragraph:

[0087] if current heading is left of the calculated heading, identify flight control instruction: AILERONS LEFT 30 DEGREES

Detail Description Paragraph:

[0088] if current heading is right of the calculated heading, identify flight control instruction: AILERONS RIGHT 30 DEGREES

Detail Description Paragraph:

[0090] when current heading matches calculated heading, identify flight control instruction: FLY STRAIGHT AND LEVEL

Detail Description Paragraph:

[0104] Exemplary methods of navigating a UAV also include flying the UAV to each waypoint in accordance with one or more navigation algorithms and operating the UAV at each waypoint in accordance with the UAV instructions for each waypoint. Operating the UAV at the waypoint in accordance with the UAV instructions for each waypoint typically includes identifying flight control instructions in dependence upon the UAV instructions for each waypoint and transmitting the flight control instructions as uplink telemetry through a socket. Flight control instructions identified in dependence upon the UAV instructions for each waypoint typically include specific flight controls to move the flight control surfaces of the UAV causing the UAV to fly in accordance with the UAV instructions. For example, in the case of a simple orbit, a flight control instruction to move the ailerons and hold them at a certain position causing the UAV to bank at an angle can effect an orbit around a waypoint.

Detail Description Paragraph:

[0128] The method of FIG. 6 includes periodically repeating (610) the steps of, receiving (602) in the remote control device from the GPS receiver a current position of the UAV, and calculating (604) a new heading from the current position to the waypoint. The method of FIG. 6 also includes identifying (606) flight control instructions for flying the UAV on the new heading, and transmitting (608), from the remote control device to the UAV, the flight control instructions for flying the UAV on the new heading. In this method, if Lon.sub.1, Lat.sub.1 is taken as the current position, and Lon.sub.2, Lat.sub.2 is taken as the waypoint position, then the new heading may be calculated generally as the inverse tangent of $((\text{Lat.sub.2} - \text{Lat.sub.1}) / (\text{Lon.sub.2} - \text{Lon.sub.1}))$.

CLAIMS:

1. A method for navigating a UAV, the method comprising: receiving in a remote control device a user's selection of a GUI map pixel that represents a waypoint for UAV navigation, the pixel having a location on the GUI; mapping the pixel's location on the GUI to Earth coordinates of the waypoint; receiving downlink telemetry, including a starting position from a GPS receiver on the UAV, from the UAV through a socket on the remote control device; calculating a heading in dependence upon the starting position, the coordinates of the waypoint, and a navigation algorithm; identifying flight control instructions for flying the UAV on the heading; and transmitting uplink telemetry, including the flight control instructions, through the socket to the UAV.

5. The method of claim 1 further comprising: receiving user selections of a multiplicity of GUI map pixels representing waypoints, each pixel having a location on the GUI; mapping each pixel location to Earth coordinates of a waypoint; assigning one or more UAV instructions to each waypoint; storing the coordinates of the waypoints and UAV instructions in computer memory on the remote control device; flying the UAV to each waypoint in accordance with one or more navigation algorithms; and operating the UAV at each waypoint in accordance with the UAV instructions for each waypoint, including: identifying flight control instructions in dependence upon the UAV instructions for each waypoint; and transmitting the flight control instructions in the uplink telemetry through the socket from the remote control device to the UAV.

16. A system for navigating a UAV, the system comprising: means for receiving in a remote control device a user's selection of a GUI map pixel that represents a waypoint for UAV navigation, the pixel having a location on the GUI; means for mapping the pixel's location on the GUI to Earth coordinates of the waypoint; means for receiving downlink telemetry, including a starting position from a GPS receiver on the UAV, from the UAV through a socket on the remote control device; means for calculating a heading in dependence upon the starting position, the coordinates of the waypoint, and a navigation algorithm; means for identifying flight control instructions for flying the UAV on the heading; and means for transmitting uplink telemetry, including the flight control instructions, through the socket to the UAV.

20. The system of claim 16 further comprising: means for receiving user selections of a multiplicity of GUI map pixels representing waypoints, each pixel having a location on the GUI; means for mapping each pixel location to Earth coordinates of a waypoint; means for assigning one or more UAV instructions to each waypoint; means for storing the coordinates of the waypoints and UAV instructions in computer memory on the remote control device; means for flying the UAV to each waypoint in accordance with one or more navigation algorithms; and means for operating the UAV at each waypoint in accordance with the UAV instructions for each waypoint, including: means for identifying flight control instructions in dependence upon the UAV instructions for each waypoint; and means for transmitting the flight control

instructions in the uplink telemetry through the socket from the remote control device to the UAV.

31. A computer program product for navigating a UAV, the computer program product comprising: means, recorded on the recording medium, for receiving in a remote control device a user's selection of a GUI map pixel that represents a waypoint for UAV navigation, the pixel having a location on the GUI; means, recorded on the recording medium, for mapping the pixel's location on the GUI to Earth coordinates of the waypoint; means, recorded on the recording medium, for receiving downlink telemetry, including a starting position from a GPS receiver on the UAV, from the UAV through a socket on the remote control device; means, recorded on the recording medium, for calculating a heading in dependence upon the starting position, the coordinates of the waypoint, and a navigation algorithm; means, recorded on the recording medium, for identifying flight control instructions for flying the UAV on the heading; and means, recorded on the recording medium, for transmitting uplink telemetry, including the flight control instructions, through the socket to the UAV.

35. The computer program product of claim 31 further comprising: means, recorded on the recording medium, for receiving user selections of a multiplicity of GUI map pixels representing waypoints, each pixel having a location on the GUI; means, recorded on the recording medium, for mapping each pixel location to Earth coordinates of a waypoint; means, recorded on the recording medium, for assigning one or more UAV instructions to each waypoint; means, recorded on the recording medium, for storing the coordinates of the waypoints and UAV instructions in computer memory on the remote control device; means, recorded on the recording medium, for flying the UAV to each waypoint in accordance with one or more navigation algorithms; and means, recorded on the recording medium, for operating the UAV at each waypoint in accordance with the UAV instructions for each waypoint, including: means, recorded on the recording medium, for identifying flight control instructions in dependence upon the UAV instructions for each waypoint; and means, recorded on the recording medium, for transmitting the flight control instructions in the uplink telemetry through the socket from the remote control device to the UAV.

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L10: Entry 5 of 5

File: USPT

May 2, 2000

US-PAT-NO: 6056237

DOCUMENT-IDENTIFIER: US 6056237 A

TITLE: Sonotube compatible unmanned aerial vehicle and system

DATE-ISSUED: May 2, 2000

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|-------------------------|----------------|-------|----------|---------|
| Woodland; Richard L. K. | Victoria, B.C. | | | CA |

APPL-NO: 08/882368 [PALM]

DATE FILED: June 25, 1997

INT-CL-ISSUED: [07] F41G 7/00, B64C 1/00

INT-CL-CURRENT:

| TYPE | IPC | DATE |
|------|--------------------|----------|
| CIPS | <u>F41 G 3/02</u> | 20060101 |
| CIPS | <u>F41 G 3/00</u> | 20060101 |
| CIPS | <u>F42 B 12/02</u> | 20060101 |
| CIPS | <u>F42 B 15/10</u> | 20060101 |
| CIPS | <u>F42 B 12/36</u> | 20060101 |
| CIPS | <u>B64 D 1/00</u> | 20060101 |
| CIPS | <u>B64 D 1/02</u> | 20060101 |
| CIPS | <u>B64 C 3/56</u> | 20060101 |
| CIPS | <u>B64 C 5/00</u> | 20060101 |
| CIPS | <u>B64 D 7/00</u> | 20060101 |
| CIPS | <u>B64 C 5/12</u> | 20060101 |
| CIPS | <u>B64 C 39/00</u> | 20060101 |
| CIPS | <u>B64 D 33/02</u> | 20060101 |
| CIPS | <u>B64 C 3/00</u> | 20060101 |
| CIPS | <u>B64 C 39/02</u> | 20060101 |
| CIPS | <u>B64 D 33/00</u> | 20060101 |
| CIPS | <u>B64 C 3/40</u> | 20060101 |
| CIPS | <u>B64 D 7/08</u> | 20060101 |
| CIPS | <u>F42 B 15/00</u> | 20060101 |

US-CL-ISSUED: 244/3.15; 244/120

US-CL-CURRENT: 244/3.15; 244/120, 244/49, 244/58

FIELD-OF-CLASSIFICATION-SEARCH: 244/3.15, D12/16.1, 102/393, 102/405, 114/21.2, 114/21.1, 114/21.3, 114/316, 89/1.8, 89/1.11, 89/1.54, 89/1.55
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

| | PAT-NO | ISSUE-DATE | PATENTEE-NAME | US-CL |
|--------------------------|----------------|---------------|---------------|----------|
| <input type="checkbox"/> | <u>D317003</u> | May 1991 | Tribe et al. | D12/333 |
| <input type="checkbox"/> | <u>2992794</u> | July 1961 | Boyd | 244/3.15 |
| <input type="checkbox"/> | <u>3916759</u> | November 1975 | Jones et al. | 89/1.814 |
| <input type="checkbox"/> | <u>5615847</u> | April 1997 | Bourlett | 244/3.15 |

ART-UNIT: 364

PRIMARY-EXAMINER: Poon; Peter M.

ASSISTANT-EXAMINER: Ducker, Jr.; Charles R

ATTY-AGENT-FIRM: Bullock; Roddy M.

ABSTRACT:

The present invention is generally comprised of a sonotube-compatible unmanned aerial vehicle apparatus, hereinafter referred to as a UAV, and systems for launch and control of the UAV. The UAV is generally comprised of modular sections including a nose section, a payload section, a wing and fuel tank section, and a powerplant section. The modular sections are attached to adjacent sections by uniform lock sealing rings and related components. The present invention comprises an apparatus enabling very small, man portable, ballistically launched, autonomously or semi-autonomously controlled vehicle to be deployed with preprogrammed, communicated, or telemetry mission programming. A wide range of payload packages, including emergency supplies, sensors, and antenna assemblies, may be carried, used or deployed in flight. Man-portable operation is accomplished by the use of a launch canister apparatus. The launch canister comprises retractable launch stabilizing legs, turbine engine exhaust orifices, and various antennas. The launch canister apparatus alternatively comprises a modified type "A", "B", or "C" sonotube launch canister. The system of the invention also comprises a portable Command, Control, Communications, Computer, and Intelligence (C4I) control and sensing analysis console. The console is preferably ruggedized, waterproof, shockproof, and comprises necessary control and analysis computers, input/output devices, antennas, and related hardware and software for vehicle and mission control. A C4I console and/or launch canisters may be transported by means of a backpack adapted for man portability.

26 Claims, 48 Drawing figures

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☐ 1. Document ID: US 20060167622 A1

L10: Entry 1 of 5

File: PGPB

Jul 27, 2006

PGPUB-DOCUMENT-NUMBER: 20060167622

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060167622 A1

TITLE: Navigating UAVs in formations

PUBLICATION-DATE: July 27, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
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| Bodin; William Kress | Austin | TX | US |
| Redman; Jesse | Cedar Park | TX | US |
| Thorson; Derral Charles | Austin | TX | US |

US-CL-CURRENT: 701/206; 701/3

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|

☐ 2. Document ID: US 20060167599 A1

L10: Entry 2 of 5

File: PGPB

Jul 27, 2006

PGPUB-DOCUMENT-NUMBER: 20060167599

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060167599 A1

TITLE: Identifying a UAV landing location

PUBLICATION-DATE: July 27, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|-------------------------|------------|-------|---------|
| Bodin; William Kress | Austin | TX | US |
| Redman; Jesse | Cedar Park | TX | US |
| Thorson; Derral Charles | Austin | TX | US |

US-CL-CURRENT: 701/16; 340/947

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|---------|
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|---------|

☐ 3. Document ID: US 20060167597 A1

L10: Entry 3 of 5

File: PGPB

Jul 27, 2006

PGPUB-DOCUMENT-NUMBER: 20060167597

PGPUB-FILING-TYPE:

DOCUMENT-IDENTIFIER: US 20060167597 A1

TITLE: Enabling services on a UAV

PUBLICATION-DATE: July 27, 2006

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|-------------------------|------------|-------|---------|
| Bodin; William Kress | Austin | TX | US |
| Redman; Jesse | Cedar Park | TX | US |
| Thorson; Derral Charles | Austin | TX | US |

US-CL-CURRENT: 701/3; 701/206

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|---------|
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|---------|

☐ 4. Document ID: US 20050094851 A1

L10: Entry 4 of 5

File: PGPB

May 5, 2005

PGPUB-DOCUMENT-NUMBER: 20050094851

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20050094851 A1

TITLE: Navigating a UAV with telemetry through a socket

PUBLICATION-DATE: May 5, 2005

INVENTOR-INFORMATION:

| NAME | CITY | STATE | COUNTRY |
|----------------------|------------|-------|---------|
| Bodin, William Kress | Austin | TX | US |
| Redman, Jesse J.W. | Cedar Park | TX | US |
| Thorson, Derral C. | Austin | TX | US |

US-CL-CURRENT: 382/106; 343/705, 382/107, 382/108, 382/154, 398/121, 701/2, 701/3, 701/36

| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. D |
|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|---------|
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☐ 5. Document ID: US 6056237 A

L10: Entry 5 of 5

File: USPT

May 2, 2000

US-PAT-NO: 6056237

DOCUMENT-IDENTIFIER: US 6056237 A

TITLE: Sonotube compatible unmanned aerial vehicle and system

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|------|-------|----------|-------|--------|----------------|------|-----------|-----------|-------------|--------|------|--------|
| Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KMIC | Draw D |
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